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A study of teachers' digital pedagogical knowledge in curriculum implementation and pupils' academic performance in Basic Technology in Osun State

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Abstract: *This paper investigates the relationship between teachers' knowledge of digital technologies and pupils' academic performance in Basic technology in Osun state primary schools. It also examines the influence of teachers' pedagogical knowledge of digital technologies in Basic Technology curriculum implementation on pupils' academic performance in the study area. It adopted a correlation research design guided by TPACK. All Basic Technology teachers and primary school pupils in Osun state constitute this study. Multistage sampling technique was used to draw 160 teachers and 270 pupils from the population to form sample size. The instrument employed to elicit data from the respondents were validated and obtained Cronbach alpha coefficient of 0.8. The collected data were regressed and found teacher's knowledge of digital technologies significantly influencing the pupils' academic performance in the Basic Technology curriculum implementation in the study area. It also shows there is no statistically significant relationship between teachers' pedagogical knowledge of digital technologies and pupils' academic performance in Basic Technology. It therefore concluded that teachers' digital pedagogical knowledge in curriculum implementation do not influence Osun state pupils' academic performance in Basic Technology. The implications were captured in the paper.*

Keywords -teacher, digital pedagogical knowledge, curriculum implementation, pupils' academic performance, basic technology

1. INTRODUCTION

Basic Technology is contained under section two of Federal Republic of Nigeria (FRN) National Policy on Education subsection C, a component of Basic Science and Technology (BST) in the document (FRN, 2013, p. 10). According to the FRN document, Basic Technology is taught in the basic education level, that is from primary (1 to 6) to junior secondary schools (1 to 3) along with other constituents like; Basic Science, Information Technology, and Health Education. Basic Technology is meant to prepare learners to undertake technology related subjects at the post-basic education level. Despite the relevance of the knowledge of Basic Technology in the development of future Nigerian society, the performance of pupils in the primary schools in the subject was low. For instance, in a study conducted by the Osun State Ministry of Education in 2019, it revealed that the average score for pupils in Basic Technology was 42% (Osun State Ministry of Education, 2019). Based on the report, this score was significantly lower than the national average score of 55%. The document further reported a wide gap in pupils' performance between urban and rural schools. The pupils in urban schools scored an average of 49%, while those in rural had average score of 35% (Osun State Ministry of Education, 2019). This then means that there are different factors that could be responsible for the observed decline. The responsible factors could be; availability of resources, teacher's characteristics, teacher content knowledge, inadequate teacher training, teaching method, lack of teacher expertise, curriculum's effect, teacher technological knowledge, teacher pedagogical knowledge, among others.

Considering availability of resources for instance, Opara and Etukudo (2014) in their study, found that instructional materials are largely unavailable, leading to underutilization in classrooms. However, the availability of school facilities for teaching and learning Basic Technology was regarded inadequate, with many schools lacking essential resources such as science laboratories, computers, and health care services (Olayinka *et al.*, 2021). In addition, Adesina and Gabriel (2023) opined that inadequacy of resources hindered teaching and learning of Basic Technology in schools. Likewise, Abidoye *et al.* (2022) claimed that the availability of facilities in schools significantly affect students learning. Based on the findings in these studies reviewed, it was instructive to know that the availability and adequacy of recourses to teaching subject like Basic Technology in Osun state schools were important. As such, this current study wish to investigate its connection with teacher's knowledge, empirically.

Generally, it is necessary to examine how much knowledge of the available facilities teachers have to utilize evolving technologies in teaching Basic Technology in Nigeria primary schools. Recent studies that explored the relationship between teachers' digital knowledge or skills and students' academic performance indicated a positive correlation between the variables (Huamán *et al.*, 2021; Youssef *et al.*, 2022).

However, teachers' digital pedagogical skills, particularly in internet surfing and using subject-related applications, were reported to be low in some contexts (Joshi *et al.*, 2023). To address these challenges, recommendations were provided, such as, teachers development with targeted training in digital skills, problem-solving, and 21st-century competencies (Joshi *et al.*, 2023; Amandac & Pañares, 2023). Additionally, the promotion of innovative and collaborative among learners use ICTs devices in education could enhance student performance (Youssef *et al.*, 2022).

In addition, recent studies have examined teachers' pedagogical knowledge of digital technologies as well as its impact on student performance revealed interesting discoveries. A good number of studies (Gumiero & Pazuch, 2024; kurniasih, 2023) discovered that teachers' technological and pedagogical knowledge are crucial for effective integration of digital tools into classrooms activities. Likewise, high levels of pedagogical digital competence among teachers correlated with increased student motivation and academic performance in subjects like physical education (Montilla *et al.*, 2023). However, some studies found that mathematics teachers' digital skills were significantly low in areas such as internet surfing and using subject-related applications (Joshi *et al.*, 2023). The research emphasized the importance of ongoing professional development to enhance teachers' digital competencies (Montilla *et al.*, 2023). When teachers possessed strong digital skills and content knowledge, they can create engaging learning environments that foster student achievement (kurniasih, 2023; Montilla *et al.*, 2023). These findings highlighted the need for continued focus on developing teachers' technological and pedagogical knowledge to improve overall instructional quality.

Curriculum implementation could be regarded as the process of putting a planned set of Basic Technology goals, learning experiences, assessments, and resources into practice within a learning environment (Hidiwakusha, 2022). This also involves translating the designed curriculum of Basic technology into actual teaching and learning experiences that occur in classrooms, labs, online platforms, or other instructional settings. According to Fullan *et al.* (2008), it is an act of applying an idea, program, or set of events that are new to the teacher in teaching Basic Technology in schools. Recent studies have shown Basic Technology curriculum implementation in Nigeria. For example, Olabiyi (2024) research revealed that various instruction learning strategies statistically and significantly enhance student achievement in basic technology when compared to use of traditional teaching methods. In addition, Musa (2025) findings showed that ICT devices were used to drive implementation of Basic Technology instruction.

However, the implementation of Basic Technology curriculum has faces several challenges like inadequate instructional resources and inappropriate teaching methods (Ahmed, Gunde, & Osu, 2025). Similarly, Ahmed, Gunde, and Maimuna (2025) found insufficient school facilities and lack of qualified man power to teach the subject. Likewise a study conducted in Edo State, Nigeria by Achuba (2025) indicated that instructional materials are inadequate while the available ones were underutilized in teaching Basic Technology. Based on the forgoing challenges confronting implementation of Basic Technology curriculum in Nigeria, it was needful to understand the influence of different variables on pupil's performance in the subject.

Few empirical research on pupils' academic performance in Basic Technology in Nigeria revealed significant relationships between various factors and student achievement. For example, a study conducted in Bayelsa State primary schools by Bokolo and Mathew-Odou (2025) demonstrated that instructional methods based on ICT, with the use of videos, animations, and interactive applications, improved pupils' engagement as well as their academic achievement. Similar to this finding, Kwabe *et al.* (2024) found use of game-based teaching strategies, mainly quiz games as well as puzzle games, these significantly improved pupils' academic performance in Basic Science and Technology rather than the conventional methods in Adamawa State. Other related studies among secondary school students were reviewed. In Edo State Model secondary schools, Oviawe (2016) investigated teacher effectiveness and student achievement and found that Basic Technology teachers' efficiency was low and it had a significant impact on the student performance in the subject. Similarly, Oni (2014) studied teacher proficiency in six Southwestern states in Nigerian and a significant relationships between teacher quality, professional experience, and the student academic performance in Basic Technology. Additionally, Raheem *et al.* (2025) researched into the influence of improvised instructional materials, on Basic Science and Technology students' performance in Lagos State. The authors found that improvisation of alternating current generating system, significantly improved students' academic achievement in Basic Science and Technology. Similarly, instruction learning strategies improved students' achievement significantly in basic technology subjects more than use of conventional teaching methods (Olabiyi, 2024).

The literature reviewed in this study consistently highlight the need to investigate the nexus between teachers' knowledge of digital technologies and pupils' academic performance in Basic Technology in Osun state primary schools as well as to examine the influence of teachers' pedagogical knowledge of digital technologies in Basic Technology curriculum implementation on the pupils' academic performance in the study area. Based on the foregoing, there are two hypotheses raised, these included;

***H_0* 1**-There is no significant relationship between teachers' knowledge of digital technologies and pupils' academic performance in Basic technology in the study area.

***H_0* 2**-There is no significant relationship between teachers' pedagogical knowledge of digital technologies in Basic

Technology curriculum implementation and pupils' academic performance in the study area.

1.2 Theoretical framework

This paper adopted The Technological Pedagogical Content Knowledge (TPACK) to understand how primary school teachers engage pupils in Basic technology while using technological devices. (TPACK) framework was introduced by Mishra and Koehler in 2005 to describe the knowledge teachers need for effective technology integration in education (Koehler *et al.*, 2015; Schmidt *et al.*, 2009). TPACK builds upon Shulman's concept of pedagogical content knowledge (PCK) by incorporating technology as a third knowledge domain (Herring *et al.*, 2016; Schmidt *et al.*, 2009). The TPACK framework explains teachers' knowledge for incorporating technology in education (Niess, 2017, 2018). The framework contains seven constructs, namely; Pedagogical Content Knowledge (PCK), technological content knowledge (TCK), Content Knowledge (CK), Technical Knowledge (TK), Pedagogical Knowledge (PK) and Technological Pedagogical Content Knowledge (TPACK). According to Niess, (2017), TPACK emphasizes the complex interaction that exist between content, pedagogical, and technological knowledge, guiding teachers in strategic thinking about when and how to apply technology for student learning. TPACK builds upon its predecessor, Pedagogical Content Knowledge (PCK), and has gained acceptance among teacher educators and researchers (Niess, 2017, 2018). The framework addresses the issue of overemphasizing technological knowledge in isolation from subject matter and pedagogical training (Chai *et al.*, 2013). Research on TPACK has employed various methods and shown positive results in enhancing teachers' ability to integrate technology in instruction (Chai et al., 2013). Continuous practice in technology integration is crucial for developing and expanding teachers' TPACK (Niess, 2017, 2018). Atinyo and Creppy (2021) study shown that teachers with high TPACK capacity are better equipped to integrate technology into the curriculum.

2. Materials and methods

2.1 Research Design

This paper adopted a correlation research design. This is to enable us determine if relationship existed between teachers' knowledge of digital technologies and pupils' academic performance in Basic Technology or not.

2.2 Population of the Study

The study population consisted of all lower primary schools' pupils, teachers and administrators in Osun state. In 2019, Osun State Government's Education-Sector Medium-Term Sector Strategy (MTSS), (2020) document reported that there were 12,188 teachers in public primary schools in Osun state. The MTSS document further revealed that a total enrolment of 357,533 pupils in Osun state public primary schools in 2019.

2.3 Sample and Sampling Technique

The sample size comprised 60 primary school teachers and 300 pupils drawn from the population. The study adopted a multistage sampling technique to select the sample size. The entire state was geopolitically stratified into three Senatorial Districts. Out of these, one Senatorial District was randomly selected. From the selected Senatorial District, one Local Government areas were drawn purposively. Likewise, 15 primary schools were selected from the Local Government Area. From each selected schools, 20 students were used for the study, totalling 300. Additionally, based on availability of teachers in the schools, convenient sampling technique was used to select teachers teaching Basic Technology in Amazing Grace Nursery and Primary Sch. (4), CAC Primary Sch. (4), God's Will Nursery and Primary Sch. (4), Standard Nursery and Primary Sch. (4), Holy Saviour's Primary Sch. (4), LA Primary Sch. Ifewara Rd Ilode (3), Living Genius Sch. (4), Narrow Way Nursery and Primary (3), OAU Primary Sch. (4), OAU Staff Sch. (4), Olatomi Kiddies Model Sch. (4), Royal Nursery and Primary Sch. (4), SDA Nursery and Primary Sch. (4), St Michael Primary Sch. (4), And St Stephen Primary Sch. (4), totalling 58.

2.4 Research Instruments

Three research instruments were used for the study. These include Survey Questionnaires, Observations Checklist and Standardized Tests. Teacher Questionnaire: A self-administered questionnaire was developed namely a teacher knowledge and implementation questionnaire (TKIQ) for teacher's digital technology knowledge and curriculum integration, this was to assess teacher's knowledge of digital technologies and their practices in integrating those technologies into the Basic Technology curriculum. A four-point Likert scale was used to gather quantitative data. Class Observations Checklist (COC) utilised was used to observe and record how digital devices were adopted in classrooms activities. Pupils' Achievement Test (PAT) was used to measure the learners' academic performance in Basic Technology. It consisted of 20 items.

2.5 Validation of the Research Instrument

The research instruments were validated by given the instruments to experts in the field of technology, the researcher's supervisor and two other curriculum experts in the Institute of Education, Faculty of Education Obafemi Awolowo University, Ile-Ife for both face and content validity. The suggestions of the experts who read through and made necessary corrections were made to the instruments. The experts reviewed the items in term of relevance to the subject matter, appropriateness of language usage and clarity of purpose. The final draft of the instrument was tested for reliability. A pilot study was conducted outside the study region, and the results were reported using Cronbach Alpha.

The statistical value of the reliability test is presented below; Cronbach's Alpha N of Items .786, 10

2.6 Procedure for Data Collection

A letter of introduction from the Institute of Education, Obafemi Awolowo University was obtained and presented to the selected school for permission to conduct the study. Thereafter, Survey Questionnaires for teachers were distributed to the selected lower primary schools in Osun State and the completed questionnaires were collected.

2.7 Methods of Data Analysis

The data collected using the above instruments were analysed through the appropriate various statistical tools; Descriptive statistics (frequency, mean, standard deviation), were used to analyze survey responses, providing an overview of the current status of digital technology integration and curriculum implementation.

Analysis of variance (ANOVA) was used to assess the strength and direction of the relationship between teachers' knowledge of digital technologies and pupils' academic performance to achieve objective (b) and answer the research hypothesis (1). In addition, a multiple regression analysis was conducted to determine the combined and relative contributions of teacher's digital technology knowledge and curriculum integration in predicting pupils' academic performance (Objective (c) and research hypothesis (2)). The analyses involved the use of a statistical package for social sciences (SPSS).

3. RESULTS

3.1 Research Hypotheses one: H_0 -There is no significant relationship between teachers' knowledge of digital technologies and pupils' academic performance in Basic technology in the study area.

To test this hypothesis, the data collected were analysed using Pearson Moment Correlation to determine if any relationship existed between teachers' knowledge of digital technologies and pupils 'academic performance in Basic Technology. The result of the analysis is presented in Table 1.

Table 1: Analysis of Teachers' Knowledge of Digital Technologies and Pupils' Academic Performance in Basic Technology

Correlation		Pupil's Score	TKDT
Pearson Correlation	Pupil's Score	1.000	-.105
	TKDT	-.105	1.000
Sig. (1-tailed)	Pupil's Score	.	.034
	TKDT	.034	.
N	Pupil's Score	300	300
	TKDT	300	300

Note: TKPT-Teacher's knowledge of digital technology, N= Total number of participants

From the analysis in Table 1, the results showed that r=-0.105, p=0.034. This result means that there exist a significant negative correlation between teachers' knowledge of digital technologies (TKDT) and pupils' academic performance in Basic Technology. Though this correlation is low. Thus, the test rejected the null hypothesis to accept that the teacher's knowledge of digital technologies has a statistical significant negative relationship with pupils' academic performance in the Basic Technology curriculum implementation in the study area.

Research Hypotheses Two: H_0: There is no significant relationship between teachers' pedagogical knowledge of digital technologies in Basic Technology curriculum implementation and pupils' academic performance in the study area.

Testing the above hypothesis, a Pearson moment correlation was used to analyse the data and result presented in Table 2. In the Table, the result showed that r=0.094 at p=0.053. The result indicating that there exist a very weak positive relationship between teachers' pedagogical and content knowledge and pupils' academic performance. Since the p-value (0.053) is marginally above the conventional alpha level of 0.05. If the value is approximated to two significant figure, the p-value will be equal to the conventional alpha value of 0.05. This would mean that the null hypothesis is therefore rejected. This indicated that there is statistically significant relationship between teachers' pedagogical knowledge of digital technologies and pupils' academic performance in Basic Technology.

Table 2: Teacher's Pedagogical Knowledge of Digital Technologies in Basic Technology Curriculum Implementation and Pupils' Academic Performance

Correlation		Pupil's Score	Teacher's Pedagogical and Content Knowledge
Pearson Correlation	Pupil's Score	1.000	.094
	Teacher's Pedagogical and Content Knowledge	.094	1.000
	Pupil's Score	.	.053

Sig. (1-tailed)	Teacher's Pedagogical and Content Knowledge	.053	.
N	Pupil's Score	300	300
	Teacher's Pedagogical and Content Knowledge	300	300

4. DISCUSSION

The finding revealed that teacher's knowledge of digital technologies has negative but significant relationship with pupils' academic performance in the Basic Technology curriculum implementation in the study area. This finding resonated with Amuah (2022)'s assertion that only a weak positive correlation existed between teachers' technological knowledge and pupils' performance in Religious and Moral Education. Likewise, Akaadom and Gorni (2023) further reveal that teachers' technological skills were positively associated with their ability to integrate ICT in teaching and learning processes. However, Vargas *et al.* (2024) found no significant correlation between teacher's ICT proficiency and academic achievement. This was similar to finding by Akaadom and Gorni (2023) who reported that many teachers struggle to create their own digital teaching materials but have modest computer knowledge.

The finding of this study also showed that there was statistically significant positive relationship between teachers' pedagogical knowledge of digital technologies curriculum implementation and pupils' academic performance in Basic Technology. This result emphasizes the need for professional development for teachers to improve their TPACK, which could lead to better educational outcomes for students in Basic Technology. This finding was in line with that of Bokolo and Mathew-Odou (2025) who revealed that teacher knowledge in implementing instructional methods driven by ICT improved pupils' engagement and academic achievement. Likewise, use of game-based teaching strategies significantly influence pupils' academic performance in Basic Science and Technology better than that of conventional methods (Kwabe *et al.,* 2024). Montilla *et al.* (2023) observed moderate to strong correlations between teachers' pedagogical digital competence and students' academic motivation in Physical Education. Similarly, Orakova *et al.* (2024) found that teachers' digital literacy levels significantly predict their pedagogical and technological competencies. Our finding also, was in line with that by Sonsupap *et al.* (2024) who found that teachers' TPACK levels significantly correlated with learners' scientific competency.

Further research may explore specific aspects of TPACK that most strongly correlate with pupil performance.

5. RECOMMENDATIONS

Based on the findings above, the following recommendations were made:

- There is need for professional development of the teachers to effectively deployed technology in the teaching and learning of Basic Technology in Osun State primary schools.
- There is also the need to integrate information and communication technology into the curriculum content of Basic Technology in the primary schools in Osun state
- There is need to conduct a research that would evaluate how digital technologies are being integrated into classroom instruction of Basic Technology in the schools.
- Technology-enabled learning environment should be promoted in the schools to foster a school culture that encourages innovative technological practices among teachers, thereby positively influencing student performance.

6. CONCLUSION

This research investigated the relationship between teachers' knowledge of digital technologies and pupils' academic performance in Basic technology in Osun state primary schools. This study concluded that there existed a relationship between teachers' knowledge of digital technologies and pupils' academic performance in Basic Technology in Osun state primary schools. Although this relationship was a negative one.

Likewise, it concluded that teachers' pedagogical knowledge of digital technologies in Basic Technology curriculum implementation influenced the Osun state pupils' academic performance in the subject considered. It became clear that the pedagogical knowledge of the teacher would determine the performance of the pupil in Basic Technology.

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10. NOTES ON CONTRIBUTORS

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